Naval Postgraduate Scho
Oceanography Departme

Departmental Overview September 2003

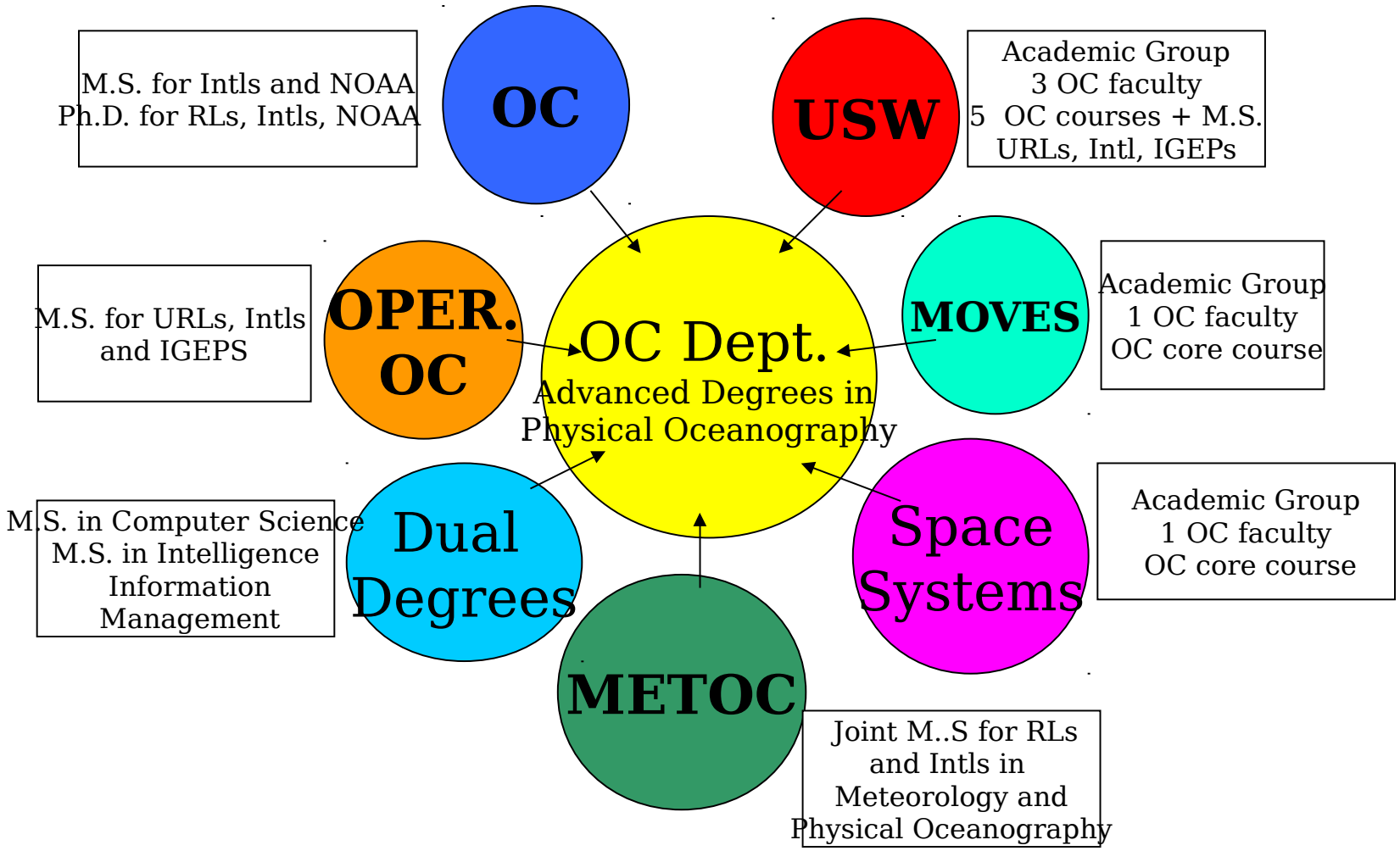
Mary L. Batteen, Chairperson

Introduction to the Oceanography Department

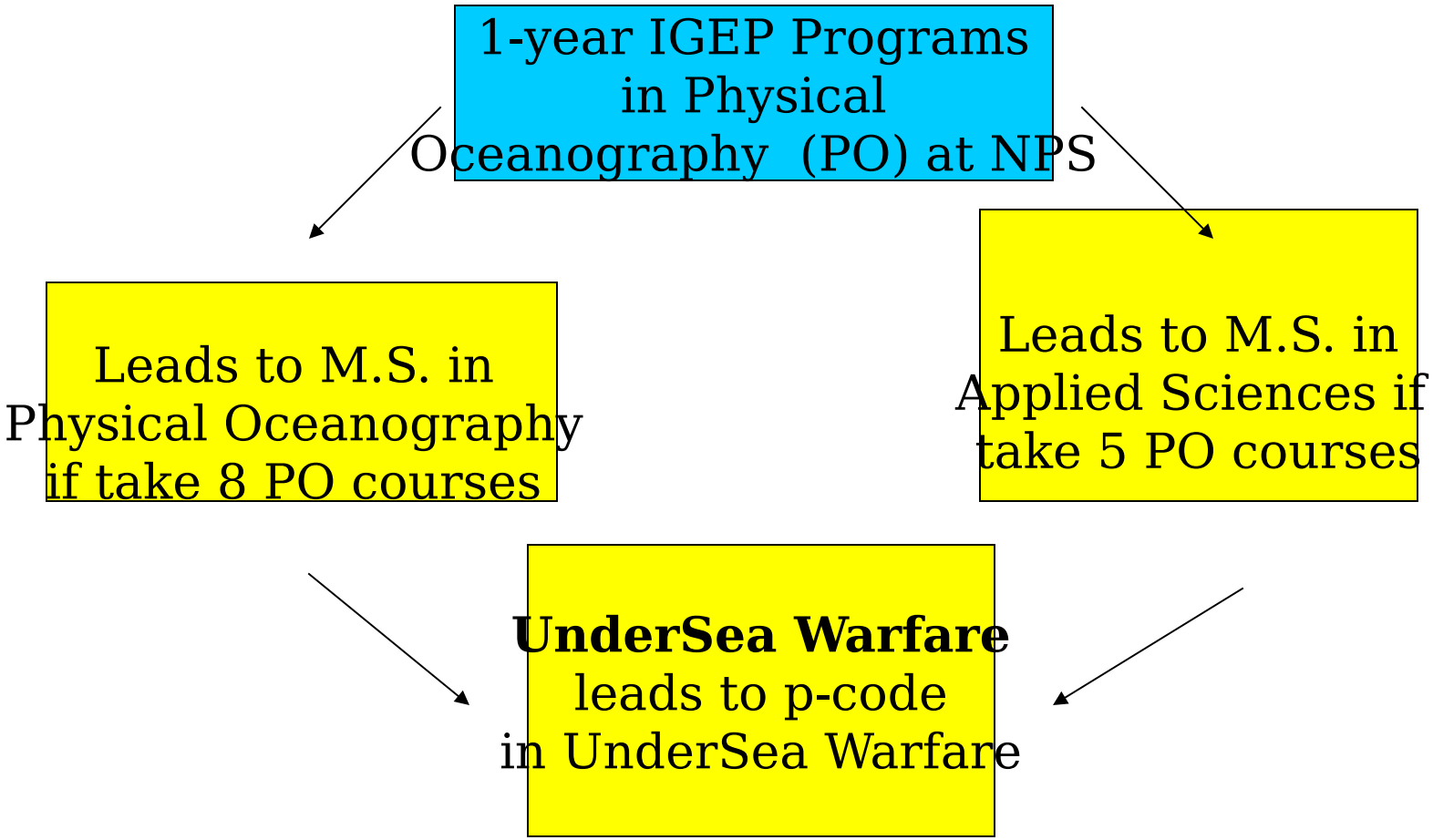
- **OC Department Educational Programs**
- **IGEP Opportunities**
- **IGEP Student Graduates 2002-2003**
- **OC Department Areas of Expertise**
- **Introduction to the METOC Program**

Oceanography Department

Educational Programs



Oceanography Options in the Immediate Graduate Education Program (IGEP)



Qualifications: High GPA in Oceanography, math or a science major.

Math through ordinary differential equations.

Point of contact at NPS: Dr. Mary L. Batteen, Chairperson, Dept of Oceanography
Naval Postgraduate School
833 Dyer Road, Bldg 232, Room 324
Monterey, CA 93943-5122
mlbattee@nps.navy.mil, (831) 656-2673

MS in Applied Science Degree
Physical Oceanography Major

Summer	**OC4270 (3-4) Tactical Oceanography**	**OC3260 (4-0) Sound in the Ocean**	**OC3230 (3-1) Desc Phys Ocn**	**MA3132 (4-0) Partial Differential Eqns**
Fall	**OC3240 (4-2) Ocean Circulation**	**OS3604 (4-0) Decision & Data Anal**	**PH3002 (4-0) Non-Acous Sensors Sys**	**OC3150 (3-2) Time Series**
Winter	**Thesis Slot**	**OA3602 (4-0) Search & Detection**	**OC4211 (4-0) Ocean Dynamics II**	**EC4450 (4-1) Sonar Sys Engineering**
Spring	**Thesis Slot**	**OA4607 (4-0) Tactical Decision Making**	**PH3479 (4-0) Phys Underwater Wpns**	**UW3303 (4-1) UW Modeling & Sim or OC4335 (3-2) Naval Ocn Anal/Pred**

Notes: This matrix requires students to have taken (1) an introductory Pro
(2) Vector Calculus and ODEs and (3) basic Electricity & Magnetism Physi

Sample Matrix for 1-year IGEP Undersea Warfare

Quarter 1	OA3602 Search Theor and Detectio	OC4900 Thesis Topics	OC 3260: Underwat Acoustics	OC 3240 Ocean Circulation	OC 2020: Computations n Air Ocean
Quarter 2	OC 4211: Ocean Waves	OC 3150 Time Series	OC 4610 Wave and Surf Forecasting	PH3002 Non-Acoustic Sensors	OC0810 Thesis
Quarter 3	EC4450 Sonar System Engineering	OC 4267 Underwater Acoustics II	OC 4270: Tactical Oceanography	OC 3570 Operational Oceanograp	OC0810 Thesis
Quarter 4	UW3303 Modeling And Simulation	OC 0999 Thesis Talk	PH3479 Underse a Weapons	OA4607 Tactical Decision Aids	OC 0810 Thesis

Undersea Warfare at NPS

for the

Immediate Graduate Education Program

Naval Postgraduate School

\+

Precision Engagement

\+

Dominant Maneuver

\+

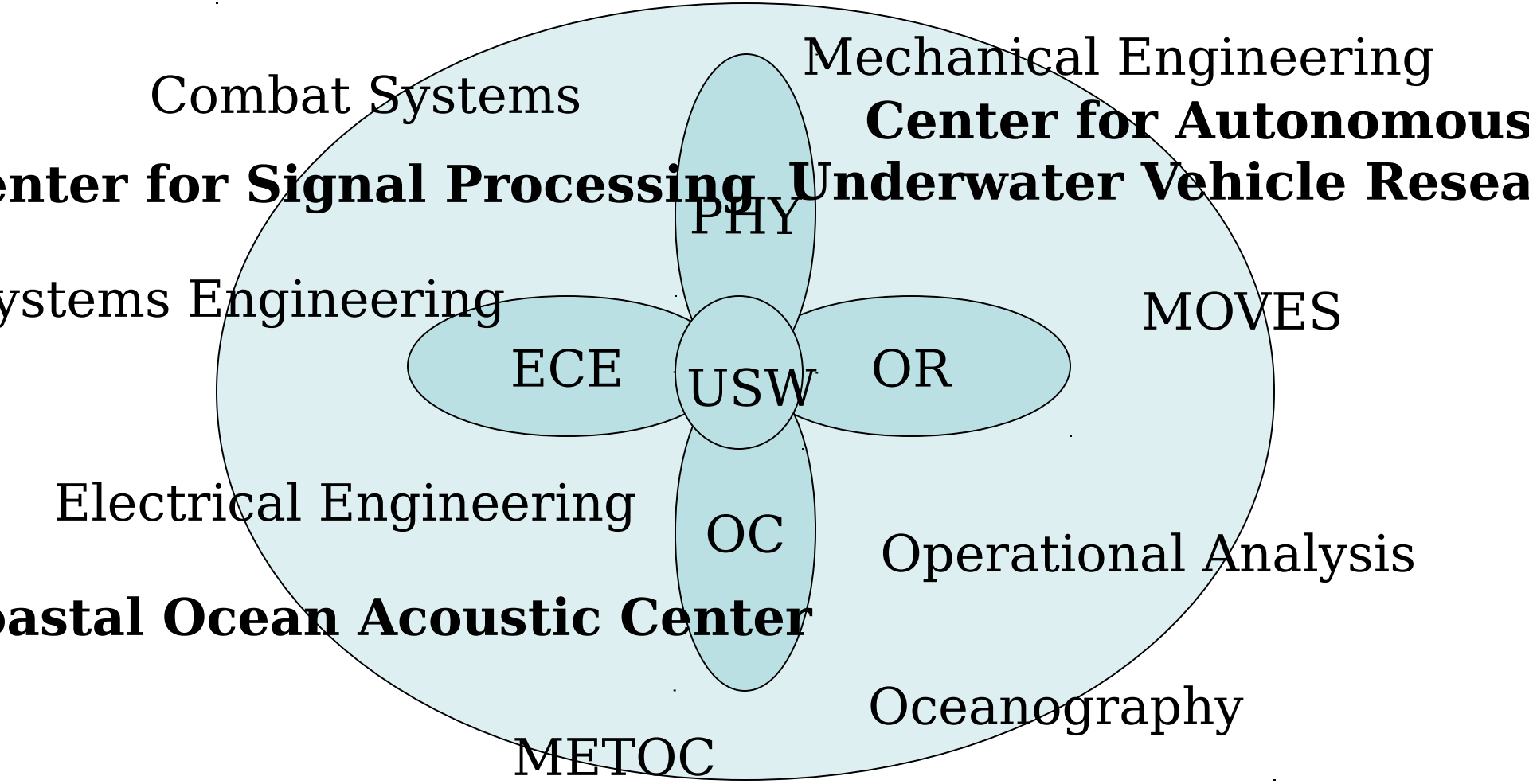
Full Dimensional Protection

\+

Focused Logistics

= *Full Spectrum Dominance and Assured Access*

Undersea Warfare Research and Education



ESRs for 6301P Subspecialty Code

Oceanography: Understand oceanographic processes influencing the performance and tactical use of UW systems.

Physics: Understand physical principles applicable to acoustic, non-acoustic UW systems and underwater weapons systems.

Acoustics: Understand acoustical phenomena affecting the design, performance, and operation of acoustic UW systems.

Operations Research: Understand computer simulation; search, detection and localization in UW modeling, as well as principles of data analysis in the evaluation of UW systems, and the use of tactical decision aids for UW systems.

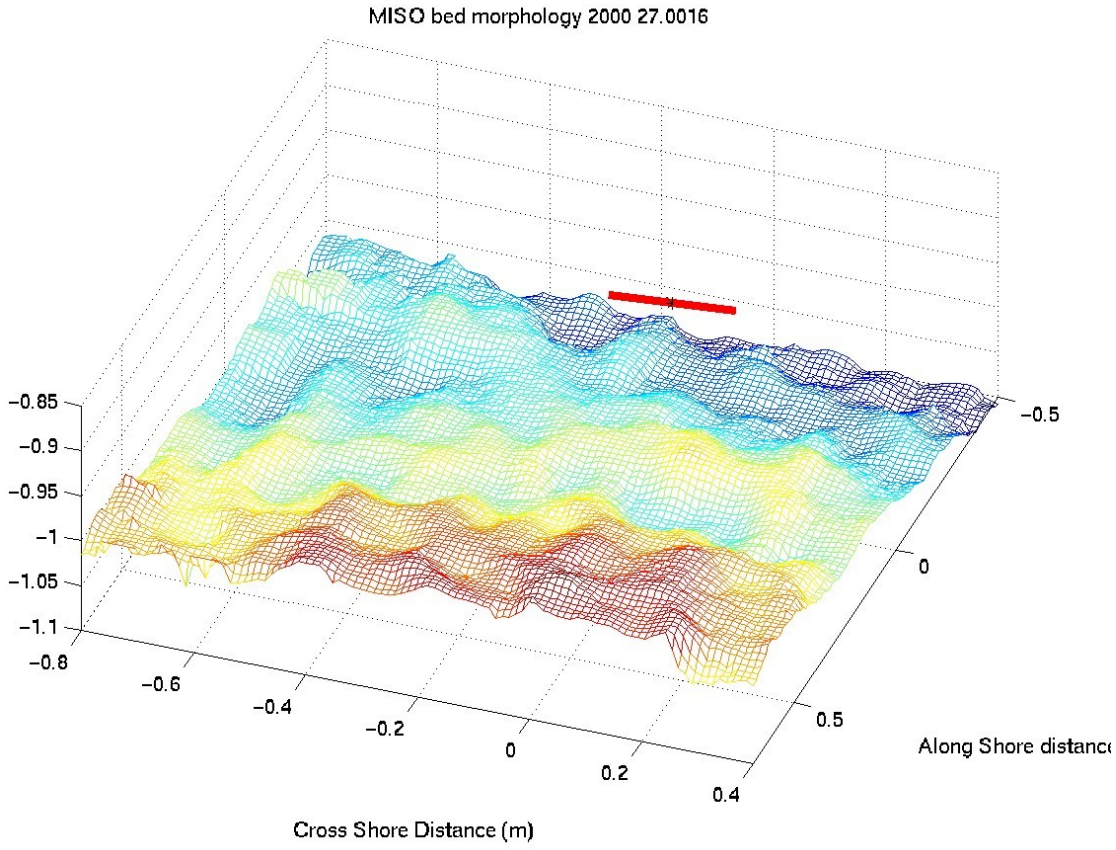
USW IGEP PROGRAM GRADUATES

GRAD DATE: JUN 02

- **Blodgett, William C., ENS/USN**
- B.S., United States Naval Academy, 2001
- MS Physical Oceanography, NPS June 2002
- Thesis title: Bedform Evolution Under the Combined Influences of Waves and Currents at the Inner-Shelf MISO site
- Thesis Advisors: Prof. Timothy P. Stanton/Prof. Edward Thornton
- **Awards: 2003 Joint National Defense Industrial Association/Assistant Secretary of the Navy (Research, Development and Acquisition)/American Defense Preparedness Award for Excellence in Undersea Warfare (USW) Technology**
- Current assignment: USS CURTIS WILBUR (DDG-54)
- Contact Info: wcblodjr@hotmail.com

Bedform Evolution Under the Combined Influence of Waves and Currents at the Inner Shelf MISO Site

Bill Blodgett, MS thesis, June 2002



USW IGEP PROGRAM GRADUATES

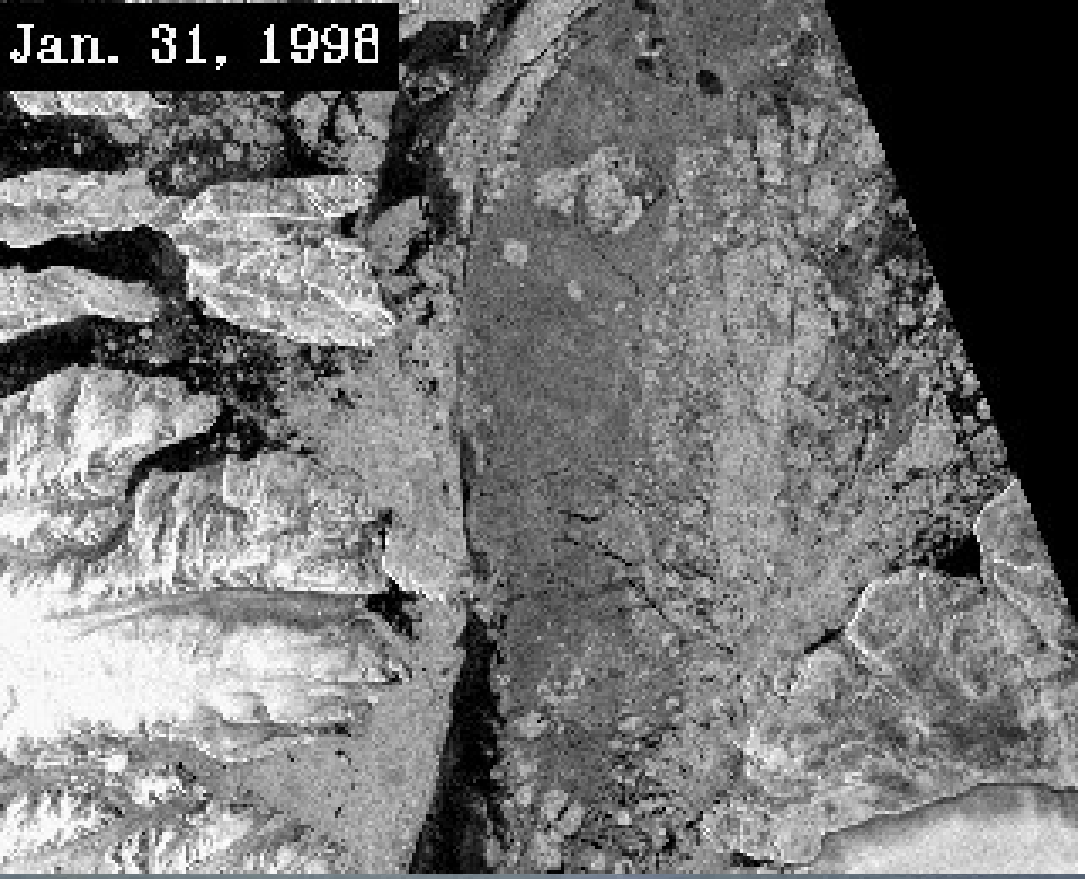
- **GRAD DATE: JUN 03**
- **Holt, Robert, ENS, USNR**
- B.S., United States Naval Academy, 2002
- MS Physical Oceanography NPS, June 2003
- Thesis title: Rip Current Spacing in Relation to Wave Energetics sand Directional Spreading
- Thesis Advisors: Prof. Edward Thornton
- Current Assignment: USS PORT ROYAL (CG73)
- Contact Info: holt@trajen.com

- **O'Malley, Colleen, ENS/USNR**
- B.S., United States Naval Academy, 2002
- MS Physical Oceanography NPS, June 2003
- Thesis title: The Fall Transition off Central California in 2002
- Thesis Advisors: Prof. Curt Collins
- Current assignment: USS BENFOLD (DDG-65)
- Contact Info: cmomalley15@yahoo.com

USW IGEP PROGRAM GRADUATES

- **Perry, Michael, ENS/USNR**
- B.S. Computer Science, Auburn 2002
- MS Applied Science (Physical Oceanography), NPS June 2003
- Thesis title: Value Aided Satellite Altimetry Data for Weapon Presets
- Thesis Advisors: Prof Peter Chu
- Current Assignment: USS THACH (FFG43)
- Contact Info: mperry62898@yahoo.com

- **Roth, Mathias, ENS/USNR**
- B.S., United States Naval Academy, 2002
- MS Physical Oceanography, NPS June 2003
- Thesis title: Effects of Thermobaricity on coupled ice-mixed layer thermodynamics
- Thesis Advisors: Prof. Bill Garwood
- Current assignment: USS PREBLE (DDG-88)
- Contact Info: maroth615@hotmail.com



Why Study Polynyas and Leads?

- Realistic prediction of ice-open water boundaries, polynyas, and deep-water formation in the polar seas will improve the Navy's mission planning, effectiveness and efficiency for all operations in the Polar Regions but particularly in the warfare area of USW.

USW IGEP PROGRAM GRADUATES

Ray, Timothy, ENS/USNR
Degree: MS Physical Oceanography
Thesis title: Wave Propagation Over Complex Bathymetry
Thesis Advisor: Prof. Tom Herbers/Prof. Edward Thornton
Next assignment: USS CURTIS WILBUR (DDG-54)
Contact Info: timothyray80@hotmail.com

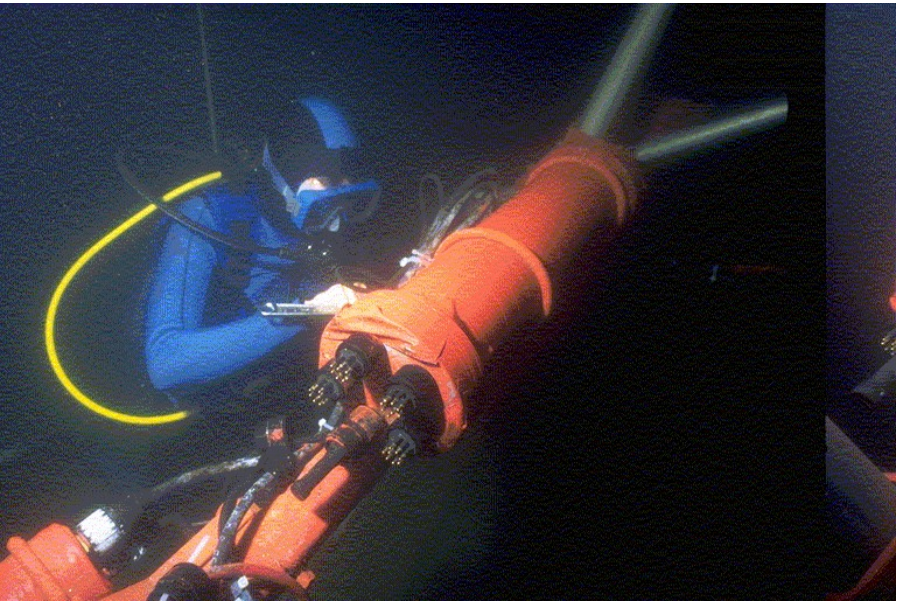
Tjoa, Kristi, ENS, USNR
Degree: MS Physical Oceanography
Thesis title: The Bottom Boundary Layer Under Shoaling Inner Shelf Solitons
Thesis Advisors: Prof. Timothy Stanton
Current assignment: USS HIGGINS (DDG-76)
Contact info: kmtjoa@hotmail.com

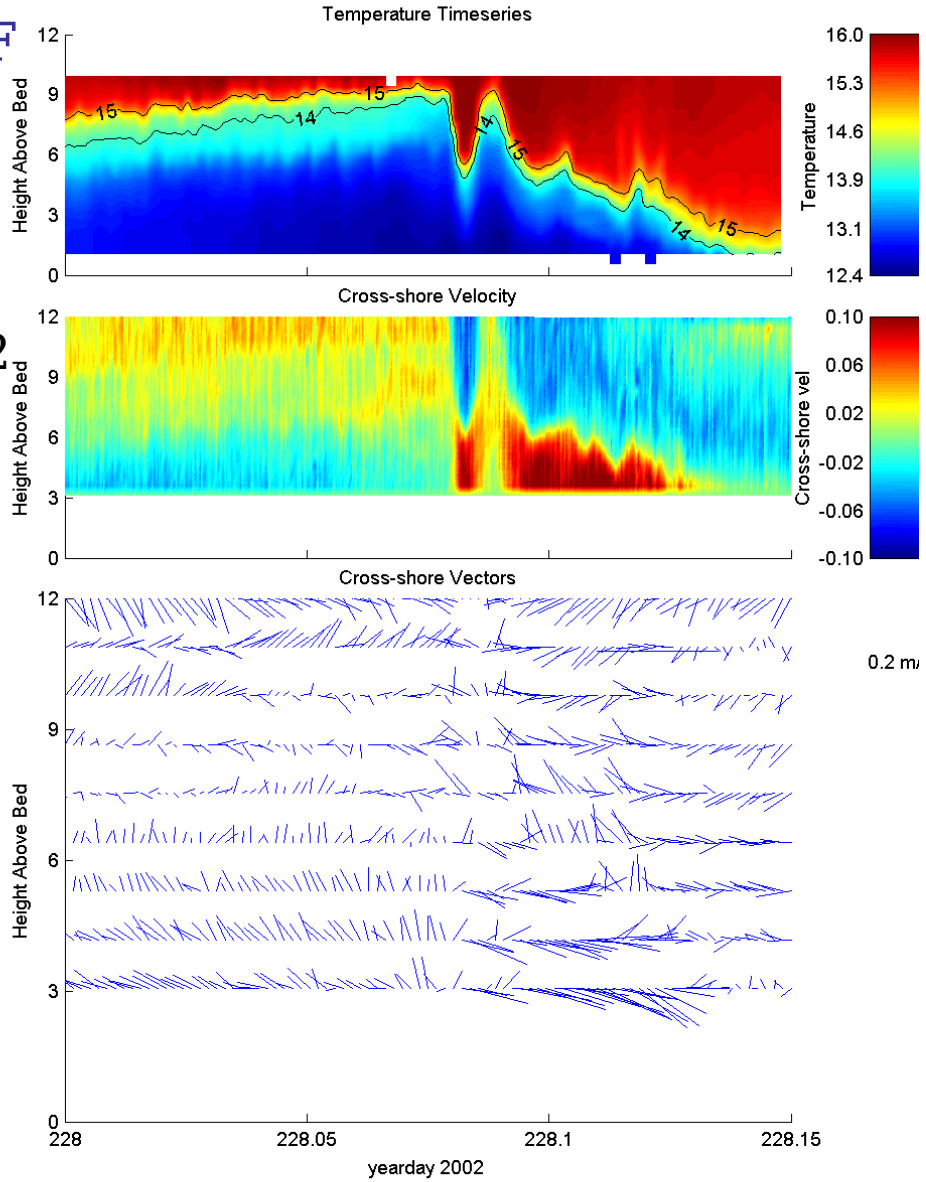
GRAD DATE: JUN 04
Class includes:
Alicia Washkevich, MS Physical Oceanography
Catherine Williams, MS Applied Science

HE BOTTOM BOUNDARY LAYER NDER SHOALING INNER SHELF SOLITONS

Kristi Mae Tjoa
Ensign, United States Navy
.S., United States Naval Academy, 2002

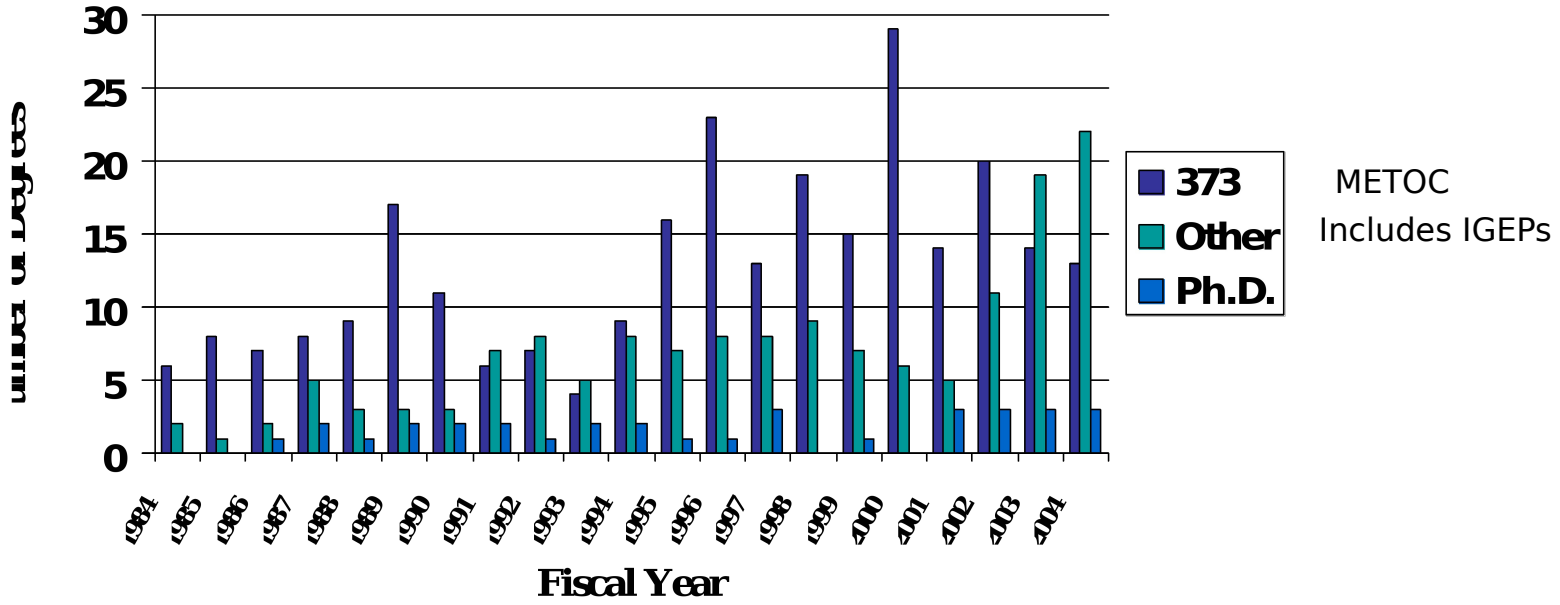
MS, June 2003, NPGS





Oceanography Department

- **Productive History**: *Since its inception in 1968, the Oceanography Department faculty have developed internationally respected research and education programs in physical oceanography.*



Oceanography Department *Research*

- **Recognized Research Program**
  - Predominately ONR and NSF funded basic (6.1 and 6.2) research with strong Naval relevance
  - Four transitioned or currently transitioning naval models
  - Cutting edge research environment for thesis research
  - Program provides emphasis on vertical integration from research programs, to observational analysis, modeling and transitioning to the Navy

Oceanography Department
The Numbers

- Balanced Faculty and Support Staff
  - Tenured Track Professors -10
  - Research Faculty - 12
  - Emeritus Faculty - 3
  - Visiting Faculty - 4
  - Military Faculty - 1
  - Senior Lecturer - 1
  - Staff - 23

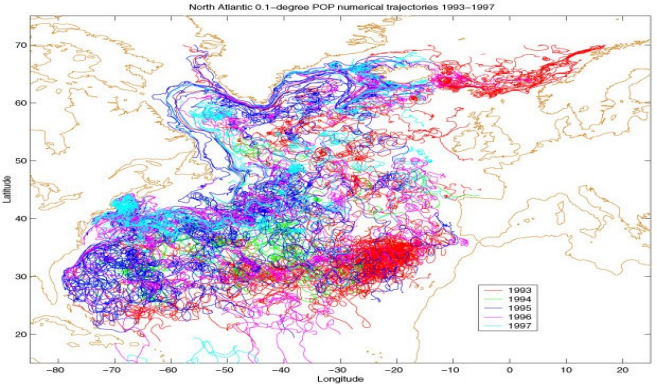
Oceanography Department
The Numbers

- Current Student Officer Demographics:
  - METOC (1800): **36**
  - Other USN (374 / USW / IGEP): **2 / 5 / 6**
  - International: **8**
  - NOAA: **2**

  Total: 56

Areas of Oceanographic Expertise

- Numerical Prediction and Data Assimilation
- Littoral Oceanography
- Nearshore
- Air-sea Interaction and Ocean Turbulence
- Acoustical Oceanography and Ocean Acoustics
- GI&S
- Polar Oceanography



Centers of Excellence in the Department of Oceanography at the Naval Postgraduate School

Numerical Prediction and Data Assimilation

The numerical prediction and data assimilation research group has helped to develop the best global ocean circulation and sea-ice models that are now available anywhere; and group members evaluate and improve their physical realism for Navy forecasting applications. Testing is conducted using DoD Grand-Challenge computing resources, and the models are being transitioned to operational status, with data assimilation included, through collaboration with Navy laboratories and related university efforts.

Centers of Excellence in the Department of Oceanography at the Naval Postgraduate School

Littoral Oceanography

The Department has specific expertise in the area of coastal ocean circulation that derives from unique instrumentation and modeling capabilities. The Radar And Drifter Laboratory is involved with surface current and wave mapping using HF radar systems and drifting buoys.These systems provide two-dimensional maps of ocean currents from the coast out to ranges of 50-200 km. Within the Moored Equipment Laboratory, state-of-the-art Acoustic Doppler Current Profilers and trawl-resistant bottom mounts allow for high frequency velocity profiles to better characterize the deeper currents and the level of internal wave activity in coastal areas. These direct measurements of coastal currents provide input to models needed to simulate and predict the 4-D environment in the coastal ocean.

Centers of Excellence in the Department of Oceanography at the Naval Postgraduate School

Nearshore Oceanography

Nearshore Oceanography is one of the strongest research programs in the U.S.. Research emphasis is on field measurements in the nearshore of waves, currents, bottom morphology combined with a vigorous program of analysis and modeling of these processes. The research is highly relevant to the Navy problems of Special Forces operations, amphibious landings, and mine and mine-counter-measures.

Centers of Excellence in the Department of Oceanography at the Naval Postgraduate School

Air-sea Interaction and Ocean Turbulence

In the Oceanic Planetary Boundary Layer Laboratory, turbulent processes are studied in the context of the integrated physics of the coupled oceanic-atmospheric systems. Analysis of air-sea interactions observations and computer modeling lead to improved naval prediction capability from regional-scale dispersion of tracers and drifters to global-scale thermohaline circulation from the polar seas to the tropics.

Centers of Excellence in the Department of Oceanography at the Naval Postgraduate School

Acoustical Oceanography and Ocean Acoustics

Our current thrusts in this area include the quantification of the physics,coherence, variability and predictability of sound propagation in littoral regions, e.g., South and East China Seas and California coastal waters, and the development and applications of acoustical remote-sensing techniques to monitor the ocean's physical properties and marine mammal activities.

Geodesy and GI&S

- Environmental effects on geolocation systems
- Marine Navigation
- GIS applications *(Airborne Topographic Mapping (ATM) LIDAR)*

Centers of Excellence in the Department of Oceanography at the Naval Postgraduate School

Polar Oceanography

For more than 30 years the Department has had a strong research program in Arctic Oceanography including participation in numerous field programs involving ice camps and ice breakers and development of numerical models to simulate the motion of sea ice and ocean currents at high spatial resolution. Observations in the field have been conducted to improve our understanding of the boundary layer processes beneath the sea ice, the circulation and water mass structure in the vicinity of the ice margin, the ice thickness distribution from submarine upward looking sonar and acoustic propagation in ice-covered waters. The high resolution Arctic models have increased our understanding of the Arctic Ocean circulation and its response to observed atmospheric forcing on daily to decadal timescales. These programs are directed towards enhancing submarine operations under ice and developing/improving Navy forecast models of sea ice concentration, thickness, and motion and Arctic weather prediction.


I’m glad they were able to predict this polynya otherwise we would have been stuck down there all winter!

METOC (373) – Summer Entry

R – Spring	MA1117 (5-2) Single Var Calculus	*MA1042 (2-0) Matrix Algebra (no Ref, then qtr 1)	EC1010 (1-1) Intro to MATLAB	*NW3230 (4-2) Strategy & Policy (no Ref, then qtr 8)	
1 – Summer	MA1118 (5-2) Multi-Var Calculus	MA2129 (5-0) Ordinary Diff Eqns	MR/OC2020 (2-2) MATLAB	OC3230 (3-1) Desc Phys Ocn	*MA1042 (2-0) Matrix Algebra (if Ref, then not needed)
2 – Fall	MA3139 (4-0) Partial Diff Eqns	MR3480 (4-1) Atm Therm & Rad Proc	MR/OC3140 (3-2) Probs & Stats	MR/OC3321 (4-0) Air-Ocn Fluid Dym	
3 – Winter	MR3222 (4-3) Met Analysis/Lab	OC3240 (4-2) Ocean Dynamic I	OC3260 (4-0) Sound in the Ocean	MR/OC3522 (4-2) Remote Sensing	
4 – Spring	MR/OC3150 (3-2) Time Series	OC4211 (4-0) Ocean Dynamics II	MR4322 (4-0) Dynamic Meteorology	OC3902 (3-2) Fund of GI&S	
5 – Summer	MR3234 (4-4) Trop & Strat/Lab	MR/OC4413 (4-0) Air-Sea Interaction	OC4267 (4-0) Ocn Acoustic Pred	OC4331 (4-0) Mesoscale Ocn Var	
6 – Fall	MR/OC4323 (4-2) Numerical Modeling	MR4416 (3-0) EM/EO	MR3252 (3-4) Tropical Met/Lab	MR/OC 4900 (V-0) Directed Study	
7 – Winter	MR/OC3570 (2-4) Operational Ocn & Met	OC4270 (3-4) Tactical Ocn	MR4240 (3-1) Coastal Met	MR/OC0810 (0-8) Thesis Research	
8 – Spring	OC4XXX (4-0) Coastal Ocn Elective	MR3262 (3-5) Operational Atm Pred	*NW3230 (4-2) Strategy & Policy (if Ref, then Elective)	MR/OC0810 (0-8) Thesis Research	
9 – Summer	MR/OCXXXX (4-0) Elective	MR/OC0810 (0-8) Thesis Research (or Elective)	MR/OC0810 (0-8) Thesis Research	MR/OC0999 (2-0) Thesis Presentation	

Curriculum 373 – METOC (6401P Code)			
Prerequisites	**Core Requirements**	**Sponsor Required Electives**	**Coastal OC Electives**
Math sequence to include:	OC 3230 (3-1) Desciptive Physical Ocn	Min 1 Coastal OC 4XXX Elective →	OC 4212 (4-0) Tides
MA 1117 (5-2) Single Variable Calculus	OC3240 (4-2) Ocean Dynamics I	MR/OC 3522 (4-2) Remote Sensing Atm & Ocn and Lab	OC 4213 (3-1) Near-shore & Wave Processes
MA 1042/3 (2-0) Matrix Algebra	OC4211 (4-0) Ocean Dynamics II	MR/OC 4413 (4-0) Air-Sea Interaction	OC 4220 (4-1) Coastal Circulation
MA 1118 (5-2) Multi-variable Calculus MA2139 (5-0) Ord Differential Eqns & Vector Analysis	MR/OC 3150 (3-2) Anal of METOC Time Series	OC 3260 (4-0) Sound in the Ocean	OC 4230 (3-0) Phys Oceanography of Monterey Bay
	MR/OC 3570 (2-4) Operational Ocn & Met	OC 4267 (4-0) Underwater Acoustics	OC 4415 (3-0) Ocean Turbulence
MA 2128 (4-0) Multi-variable Calc & Vector Analysis MA 2121 (4-0) Ordinary Differential Equations	MR3234 (4-4) Trop & Strat Analysis & Lab	OC 4270 (3-4) Tactical Oceanography	OC 4610 (2-2) Wave & Surf Forecasting
	MR 4322 (4-0) Dynamic Meteorology	OC 3902 (3-2) Fundamentals of GI&S	
MA 3132/9 (4-0) Partial Diff Eqns and Fourier Transforms	MR/OC 4323 (4-2) Numerical Air & Ocn Modeling	OC 4331 (4-0) Mesoscale Ocean Variability	
MR/OC 2020 (2-2) MATLAB	20 additional hours of MR/OC 4XXX electives balanced between MR and OC	MR 3252 (3-4) Tropical Met and Lab	
MR 3480 (4-1) Atm Thermodyn/Radiative Proc		MR 3262 (3-5) Operational Atm Prediction & Lab	
MR/OC 3140 (3-2) Probability & Statistics	**MR or OC Thesis related**	MR 4240 (3-1) Coastal Meteorology	
MR/OC 3321 (4-0) Air/Ocn Fluid Dynamics	MR or OC 4900 (V-0) Directed Study	MR 4416 (3-0) Atm Factors in EM/EO	
MR 3222 (4-3) Meteorological Analysis	MR or OC 0810 (~3) (0-8) Thesis Research		
	MR or OC 0999 (2-0) Thesis Presentation	NW 3230 (JPME) (4-2) Strategy & Policy	

Also offer Ph.D. degrees in Physical Oceanography.
Latest graduate of this program will be Henry Jones
who will graduate from NPS on 26 September 2003.

Dissertation Title:

SENSITIVITY OF A NAVY REGIONAL OCEAN MODEL TO HIGH-RESOLUTION ATMOSPHERIC AND SCATTEROMETER WIND FORCING

Henry Jones
B.S., United States Naval Academy, 1979
M.S., Naval Postgraduate School, 1986

DOCTOR OF PHILOSOPHY IN PHYSICAL OCEANOGRAPHY
Ph.D. Thesis Advisor: Mary L. Batteen

Just starting the Ph.D.: Carl Hager, Future PMP Instructor
at the Naval Academy and Henry (Tony) Miller

Questions:

- **Point of contact at NPS: Dr. Mary L. Batteen, Chairperson, Dept of Oceanography**
- **Naval Postgraduate School**
- **833 Dyer Road, Bldg 232, Room 324**
- **Monterey, CA 93943-5122**
- **mlbattee@nps.navy.mil**
- **Phone: (831) 656-2673**